REMARKS/ARGUMENTS

The claims are 1, 2 and 4-11. Claim 1 has been amended to better define the invention and to incorporate the subject matter previously appearing in claim 3. Accordingly, claim 3 has been canceled. In addition, new claims 10 and 11 have been added directed to a method for generating tunable light pulses. These claims are similar to claim 1 and differ only slightly from each other with regard to their formulation. The specification has also been amended to clarify the term "microstructured photonic fibers" as requested by the Examiner. Reconsideration is expressly requested.

The disclosure was objected to for using the term "microstructured photonic fibers", which the Examiner has presumed to refer to a set of structures that include Bragg fibers and photonic crystal fibers. In response, Applicants have amended the specification to refer to photonic crystal fibers as suggested by the Examiner; however, the term "microstructured photonic fibers" is not intended to include Bragg fibers because such Bragg fibers do not change the spectral intensity distribution of a light pulse, which is an important point of the present invention. It is respectfully requested that the

foregoing amendment overcomes the objections of the Examiner to the specification, and Applicants respectfully request that the objections on this basis be withdrawn.

Claims 1-9 were rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. Specifically, the Examiner has objected to the recitation in claim 1 that the optical fiber takes advantage of "solitonic effects". In the Examiner's view, soliton is a noun that describes a pulse that has no net dispersion, which is an effect and not a cause, and what the Applicant means by solitonic effects is, in the Examiner's view, neither clear nor disclosed.

In response, Applicants have amended claim 1 to better define the invention, and has added new claims 10 and 11, and respectfully traverses the Examiner's rejection for the following reasons. Under 35 U.S.C. 112, the description of the invention need be only in such full, clear and concise and exact terms as to enable any persons skilled in the art to which it pertains, or to which it is most nearly connected, to make and use the same. It is respectfully submitted that the non-linear optical effects, namely the solitonic processes, on which the method of functioning of the device of claim 1 is based, were known in the

technical literature and also in the patent literature on the priority date of the patent application, and would have been well understood to a person of skill in the art. As a result, it is respectfully submitted that Applicants' patent application need not say anything with regard to the characteristics that the Examiner has objected to. As instructed by the Federal Circuit in In re Wands, 8 U.S.P.Q.2d 1400, 1402 (Fed. Cir. 1988), because patents are written to enable those skilled in the art to practice the invention, a patent "need not disclose what is well known in the art." Such disclosures are unnecessary because the information required to enable a person skilled in the art to practice the invention based on Applicants' disclosure was already available elsewhere in the form of previously-published literature.

In this connection, the Examiner's attention is directed for example, to *U.S. Patent No. 6,618,531* to *Goto et al.* The publication of the application on which this U.S. Patent was based took place as early as April 2000. From *Goto et al.*, it is known to use nonlinear effects that occur in optical fibers, for the purpose of generating light pulses. In column 5 of *Goto et al.*, it is particularly disclosed that because of solitonic effects in the optical fibers, frequency conversions,

specifically frequency shifts ("soliton self frequency shift") can occur.

The solitonic processes in question are furthermore known from the general technical literature. For example, a textbook by G.P. Agrawal ("Nonlinear Fiber Optics," 3rd edition, Academic Press, San Diego, 2001, Chapter 5.2.3), explains nonlinear frequency conversions based on solitonic effects under the key word "Higher-Order Solitons."

Furthermore, it should be noted that the occurrence of solitonic effects is a general property of a light guide having abnormal dispersion and nonlinearity. The connections between dispersion, nonlinearity, duration of the light pulses, and energy of the light pulses that lead to the occurrence of a soliton are discussed in detail in the literature. See, for example, the G.P. Agrawal textbook referred to above.

It is respectfully submitted that one reading Applicants' specification, in light of the general knowledge of the art, would know how to construct a device for generating tunable light pulses, and to perform a method for generating tunable light pulses as recited in claim 1, as amended, and in new claims 10

and 11 so as to apply pulses having suitably selected parameters to a nonlinear optical fiber, in such a manner as to generate the desired tunable output light pulses. Accordingly, it is respectfully submitted that claim 1, as amended, and new claims 10 and 11, are fully supported by the specification, and Applicants' respectfully request that the objections on this basis be withdrawn.

Claims 1 and 3 were rejected under 35 U.S.C. 102(b) as being anticipated by *Galvanauskas et al.* (U.S. Patent No. 5,499,134). The remaining claims were rejected under 35 U.S.C. 103(a) as being unpatentable over *Galvanauskas et al.* alone (claims 2, 7 and 8) or further in view of *Broeng et al.* (U.S. Patent Application Publication No. 2002/0131737) and *Knight, "Photonic Crystal Fibres"* (claims 4-6) or, in view of *Svilans et al.* (U.S. Patent No. 6,915,030) (claim 9). Essentially, the Examiner's position was that *Galvanauskas et al.* discloses the device for generating tunable light pulses recited in the claims, except for features which are either considered within the skill of the art or disclosed by *Broeng et al.*, the *Knight* article or *Svilans et al.*

In response, Applicants have amended claim 1 to better define the invention and respectfully traverse the Examiner's rejection for the following reasons.

As set forth in claim 1, as amended, Applicants' invention provides a device for generating tunable light pulses including a pulse laser light source for producing femtosecond light pulses having an optical spectrum, an adjustable optical compressor for changing the temporal frequency progression ("chirp") of the light pulses output from the pulse laser light source, and a non-linear optical fiber for modifying the optical spectrum of the femtosecond light pulses and for tuning the generated light pulses coupled out of the non-linear optical fiber to the desired wavelength in accordance with the chirp of the light pulses received from the adjustable optical compressor.

As set forth in new claims 10 and 11, Applicants' invention provides methods for generating tunable light pulses in which femtosecond light pulses having an optical spectrum are produced, the chirp of the femtosecond light pulses is regulated, and the light pulses are input into a non-linear optical fiber in order to generate output light pulses. As recited in claim 10, the output light pulses have a modified optical spectrum due to non-

linear soliton effects occurring in the optical fiber, wherein the spectrum of the output light pulses is tuned in accordance with the regulated chirp of the input light pulses. As recited in claim 11, the output light pulsed are frequency-shifted, with the frequency shift depending on the predetermined chirp of the input light pulses.

Galvanauskas et al. fails to disclose or suggest the device and method for generating tunable light pulses recited in the claims in which the optical spectrum of femtosecond light pulses output from a pulse laser light source is changed by means of a non-linear optical fiber, and in which tuning of the wavelength of the light pulses generator takes place in accordance with a previously set frequency progression of the input light pulses. In *Galvanauskas et al.'s* system, so-called "chirped Bragg gratings" are used as optical compressors or stretchers, respectively, which cannot be tuned. The Bragg gratings used in *Galvanouskas et al.'s* system are produced by means of structuring optical fibers. A variable change in the temporal frequency progression ("chirp") of the light pulses as recited in amended claim 1 and new claims 10 and 11 is not possible with *Galvanouskas's* system.

Moreover, Applicants' device as recited in claim 1, as amended, differs from *Galvanouskas et al.* in that the optical spectrum of the light pulses is changed by means of the nonlinear optical fiber, whereby tuning of the wavelength of the light pulses generated takes place, in accordance with the previously set temporal frequency progression of the input light pulses. In *Galvanauskas et al.* however, the matter of concern is the known technique of chirped pulse amplification to amplify light pulses. In this connection, the specific matter of concern is that the input light pulses and the output light pulses have the same wavelength. With regard to the Fig. 6 of *Galvanauskas*, this feature means that the spectrum of the input light pulse (10a) is identical with the spectrum of the output light pulse (10d). In contrast, in Applicants' device and method, the important thing is that the input and output light pulses have different wavelengths.

Although the Examiner has taken the position that any material possesses optically nonlinear properties, so that the fiber coupler (18b) that is shown in Fig. 6 of *Galvanauskas et al.*, necessarily constitutes a nonlinear optical fiber as recited in Applicants' claims, it should be pointed out that the fiber coupler being used in *Galvanauskas et al.* does not have any

nonlinear optical properties as recited in Applicants' claims 1, 10 and 11, because in *Galvanauskas et al.'s* system the matter of concern is not to modify the spectrum of the light pulses.

In new claims 10 and 11, it is made clear that the matter of concern is to regulate the temporal frequency progression ("chirp") of the femto-second light pulses in such a manner that the output light pulses generated by means of the nonlinear optical fiber have a tunable wavelength that is dependent on the pre-adjusted chirp.

There is no disclosure or suggestion in any of the references cited by the Examiner of achieving tunability of light pulses by means of varying the chirp of the input light pulses in targeted manner. In this connection, Applicants' invention takes advantage of the sensitive dependence on the chirp of the solitonic processes that take place in the nonlinear optical fiber, so that the wavelength of the output light pulses can be tuned by means of pre-adjustment of the chirp.

The remaining references cited by the Examiner have been considered, but are believed to be no more pertinent. *Broeng et al.* discloses a polarization preserving optical fiber having a

cladding with elements having a non-circular cross-section. *Knight* relates to photonic crystal fibers having wavelength-scale morphological microstructure running down their length. Both *Broeng et al.* and *Knight* refer to specific micro-structured photonic fibers as well as their characteristics. Although such fibers may be used in Applicants' device and method to produce light impulses having variable wave length, taking advantage of solitonic effects, neither *Broeng et al.* nor *Knight* give any hint of such a use, and there is no disclosure or suggestion of connecting an adjustable compressor in series to the fibers, according to the claim 1, as amended, and new claims 10 and 11 in order to influence the temporal frequency progression of the input light pulses.

Svilans et al. discloses an optical spectrum analyzer for monitoring channel status or detecting location at a number of working channels from a wave-length division multiplexed (WDM) signal. However, there is no disclosure or suggestion of a device or method for generating tunable light pulses that uses an adjustable optical compressor and a non-linear optical fiber connected at the output side of the compressor.

None of these references discloses or suggests Applicants' device and method as recited in claim 1, as amended, or new claims 10 and 11, in which the light pulses coupled out of a non-linear optical fiber are tuned to a desired wave-length in accordance with the chirp of the light pulses received from an adjustable optical compressor.

Accordingly, it is respectfully submitted that claim 1, as amended, and new claims 10 and 11 are patentable over the cited references, together with claims 2 and 4-9, which depend on claim 1, as amended.

In summary, claim 1 has been amended, claim 3 has been canceled, and new claims 10 and 11 have been added. The specification has also been amended. In view of the foregoing, it is respectfully requested that the claims be allowed and that this case be passed to issue.

Applicants also submits herewith a Supplemental Information Disclosure Statement listing the *Goto et al.* and *G.P. Agrawal* references discussed in this Amendment, and also listing the primary reference to *Galvanaukas et al.* which the Examiner

inadvertently did not formally make of record by listing on the Form-892 attached to the Office Action.

Respectfully submitted,

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Enclosures: Copy of Petition for 3-month extension of time
Supplemental Information Disclosure Statement

I hereby certify that this correspondence is being deposited with the U.S. Postal Service as first class mail in an envelope addressed to: Commissioner of Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on April 12, 2006.

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